Space Weather Technical Forecast

Issued on Thursday, 21 October 2021 at 13:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of Active fluence by Day 4 (24 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low, with a slowly rising x-ray flux. A few B-class flares have been observed in relation to a likely new active region close to emerging from the southeast limb. Otherwise, there is currently one active region on the visible disc, AR2886 (Hsx/Alpha), in the southeast quadrant. This region appears to be stable with a magnetically simple configuration. No new Earth-directed CMEs were observed in available imagery in the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as measured by DSCOVR at L1, started slow-ambient with a general enhancement from 20/1800 UTC to become elevated from 20/2330 UTC with a peak reaching 561 km/s at 21/0105 UTC. Density was average to above average with a peak of 22 ppcc at 20/1813 UTC. Total IMF, Bt, was Weak to Moderate with a peak of 13 nT. Bz remained Weak between +6/-6 nT after 20/1945 UTC. The Phi angle has been mainly negative (towards the Sun). Resultant geomagnetic activity was Quiet (Kp -2). These parameters suggest a recent connection to the high speed stream from negative coronal hole CH13/-.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 was at background levels, with no solar radiation storms observed. High energy electron flux (greater than 2 MeV) was at background levels. Associated 24-hour electron fluence was on a fairly steady trend, well below the Active (1e8 integrated pfu) threshold, with 1.59e6 integrated pfu recorded at 21/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at low or very low levels through the next few days, but perhaps with an increase in flare probabilities as the anticipated new active region rotates onto the southeast limb.

Solar Wind / Geomagnetic Activity: Solar winds are currently elevated due to connection to CH13/- before slowly declining through Days 2 and 3 (22-23 Oct).Geomagnetic activity is likely to be Quiet to Unsettled, with isolated Active intervals on Days 1 and 2

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with no solar radiation storms expected. The high energy electron flux (greater than 2MeV) is currently at background levels, but may show a rising trend through the next 4 days as the fast wind from CH13/- charges the radiation belts. The 24-hour fluence may also show a rising trend, with a chance of becoming close to the Active (1e8 integrated pfu) threshold by the end of Day 4 (24 Oct).

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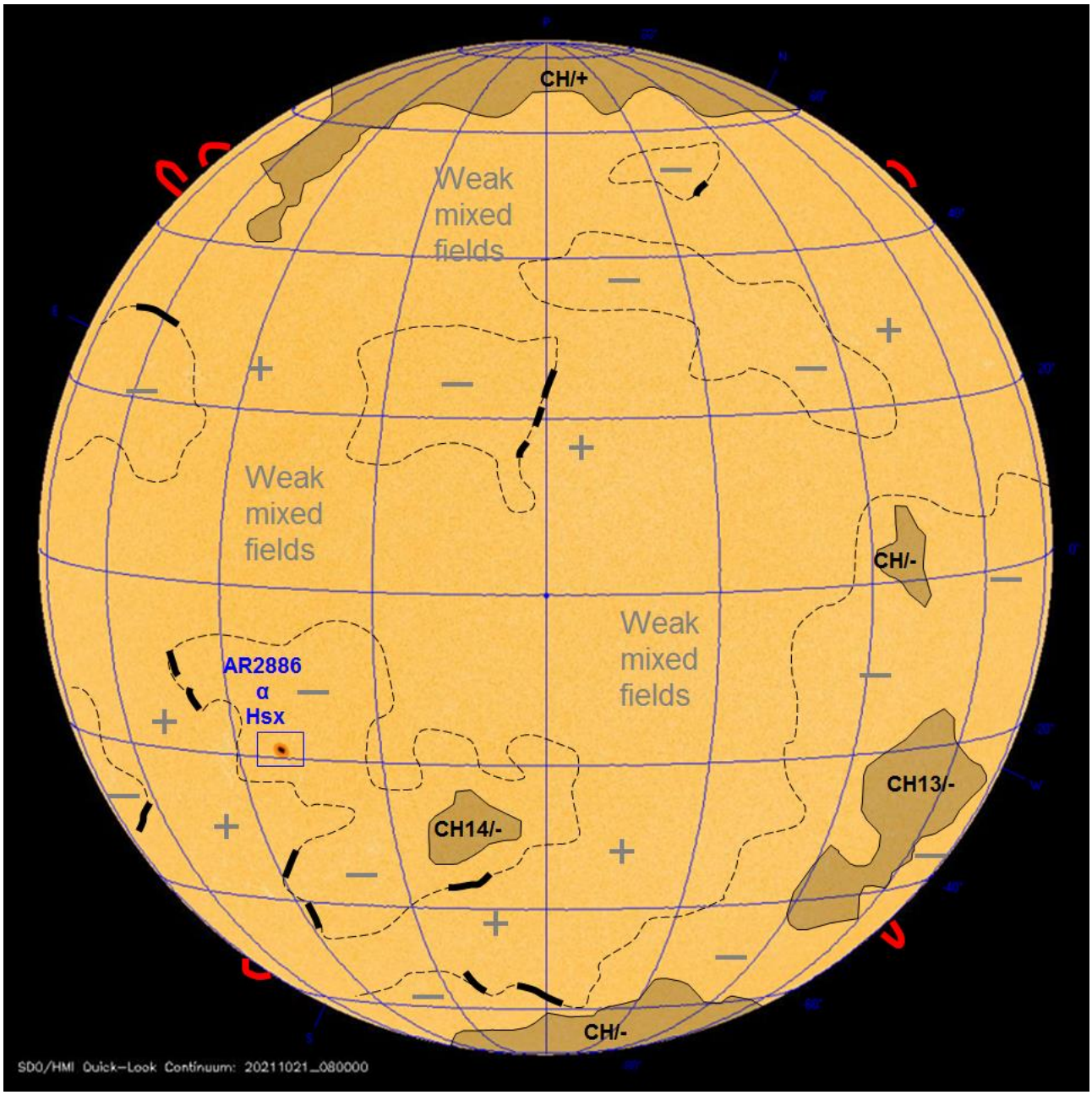
Figure 1. Solar Analysis Valid 0800 UTC, 21 October 2021.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are currently elevated around 520 km/s due to coronal hole influences related to CH13/-. The hole is slightly more advanced than on the previous rotation and as such solar winds have likely peaked with a steady decline during Day 2, continuing into Day 3 (22-23 Oct).

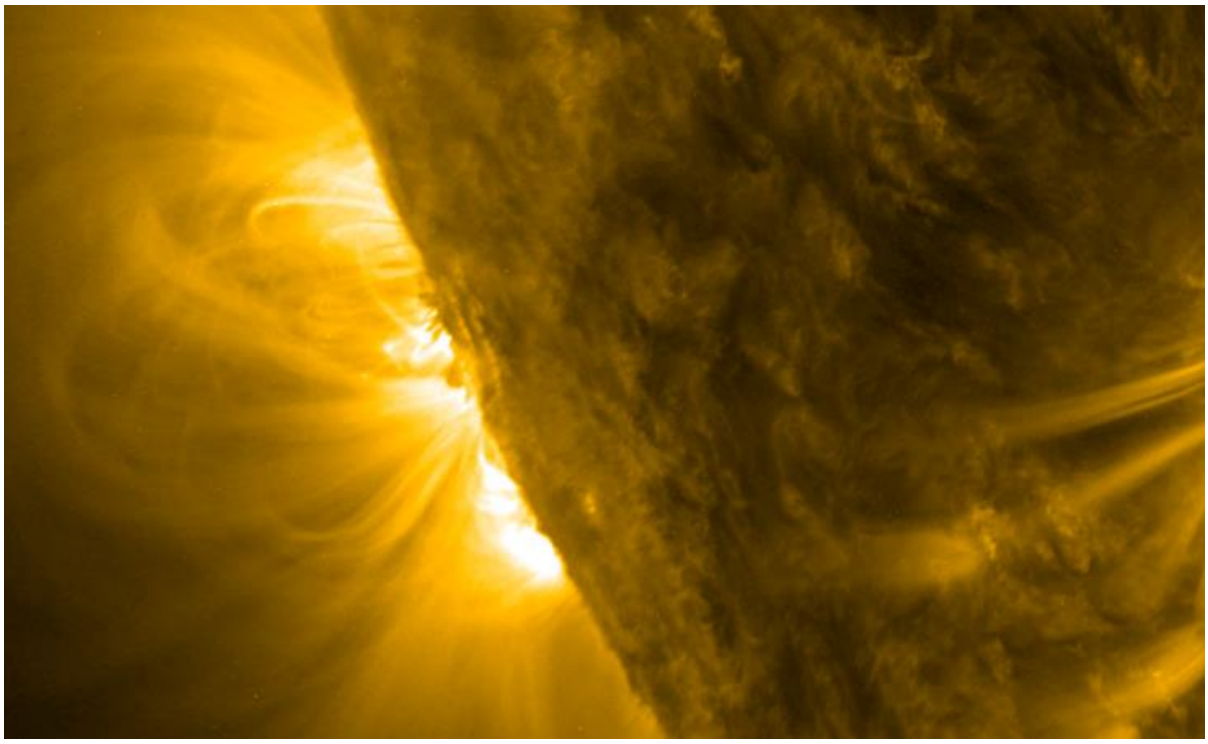
Geomagnetic activity is predicted to be Quiet to Unsettled, with isolated Active intervals on Days 1 and 2.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: SDO-aia satellite imagery showing emerging active region on southeast limb.



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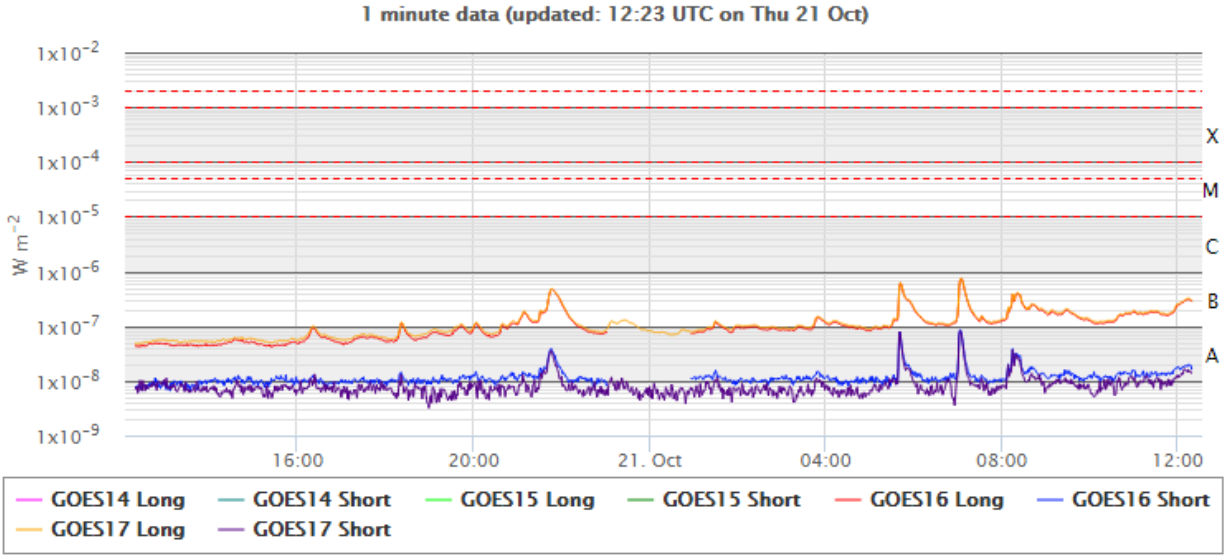
Radio Blackouts - X-Ray Flares:
Solar activity is expected to be at low or very low levels through the next few days.
There is one numbered active region on the visible disc at present, AR2886 (Hsx/Alpha), located in the southeast quadrant. This region remains in a stable appearing configuration with no notable flares observed during the ipast 24 hours. However, a bright region of flux observed in STEREO-A EUVI imagery is probably a new active region, which will rotate into view across the southeast limb of the visible disc in the next 12-18 hours. This region is already responsible for an increase in the background levels of x-ray flux, with a few B-Class flares observed. As such, the probability of flaring is likely to increase over the next few days, and this is reflected in increased probabilities for M-Class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	2	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES X-ray flux indicating recent B-Class flares from new emerging active region.



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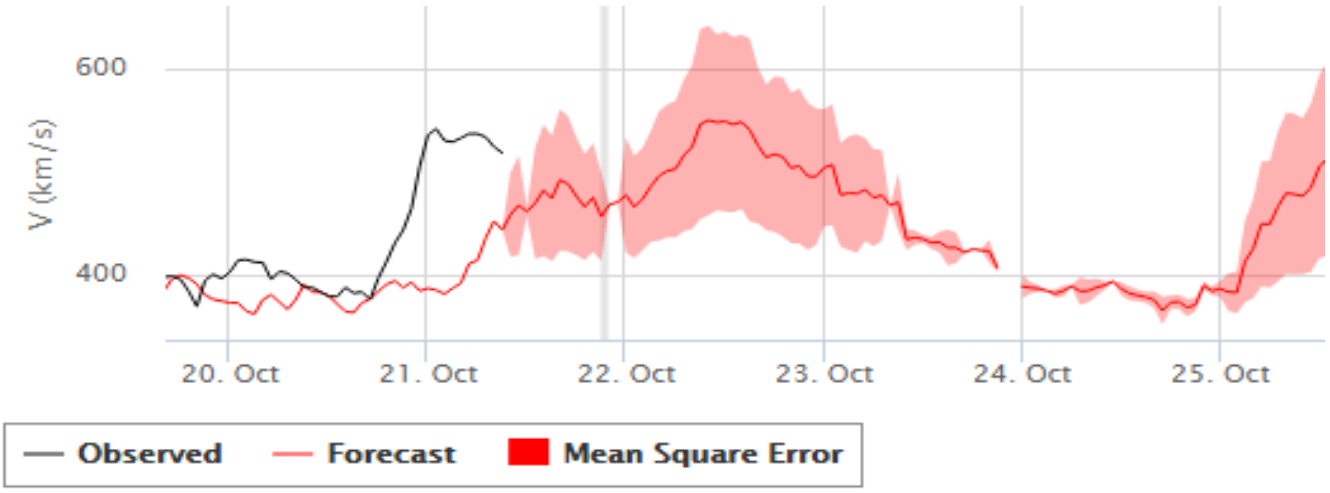
Solar Radiation Storms - (High Energy Protons):
With no significant flare activity forecast for this period, and only one active region currently in the eastern hemisphere, solar radiation storms are not expected.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office SWPM output showing likely decline from day 2.



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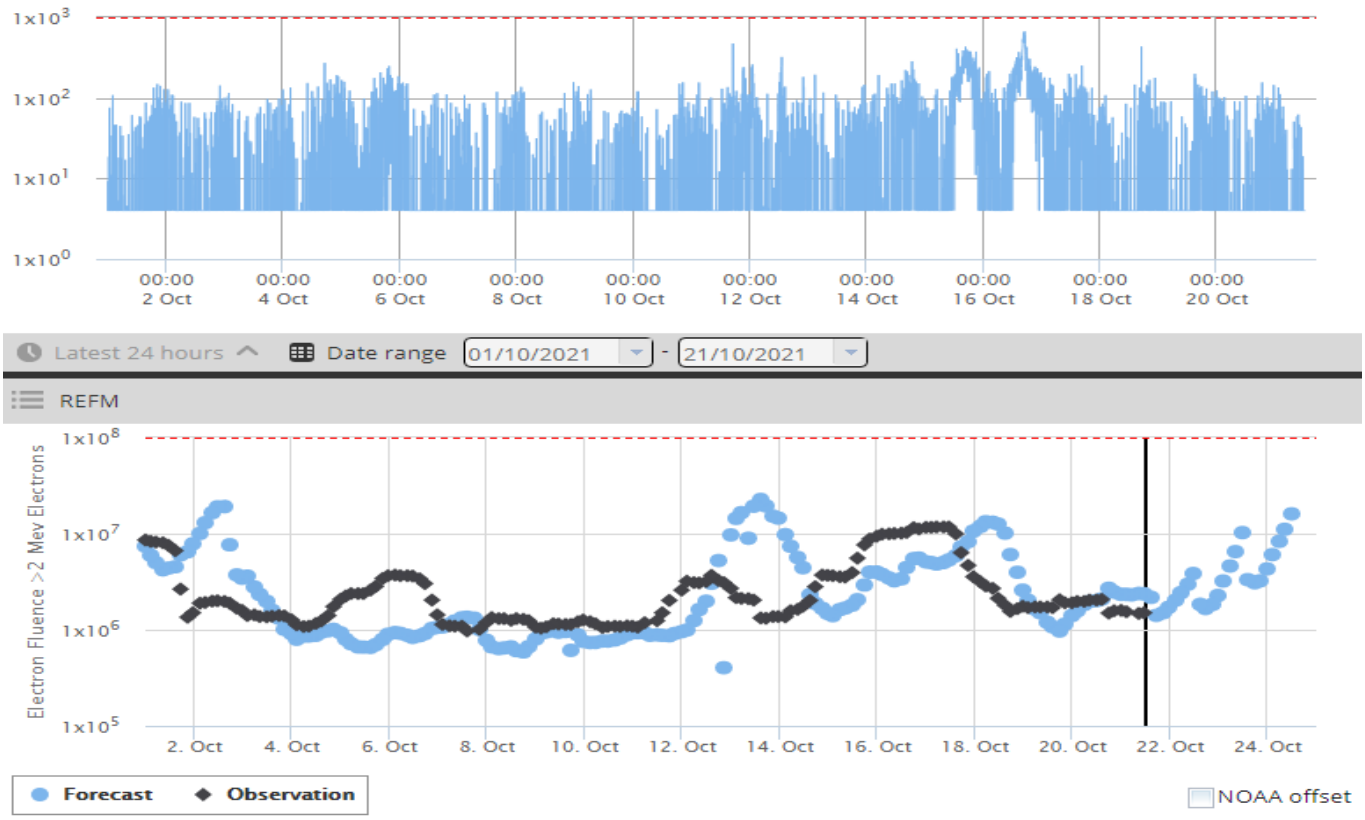
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is currently at background levels. The recent arrival of a high speed stream from CH13/- is likely to keep electron levels suppressed through the early part of the period as the radiation belts are likely to be compressed from the faster solar wind speeds. However, this increase in wind speeds may drive an increase in flux levels, which may then give a flux increase at GEO later in the period. Flux levels rose on the previous rotation, but not above the High (1000 pfu) level.

The electron fluence is currently well below the Active (1e8 integrated pfu) threshold on a steady trend. Fluence levels will probably rise through the period as the high speed stream effects wane. There is a chance of seeing fluence close to Active threshold by the end of Day 4 (24 Oct). REFM is not currently indicating an increase in fluence levels, but this may be due to the lack of response on the previous rotation and is potentially somewhat under-estimating fluence levels.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux (>2MeV) and Met Office REFM output since start of October.



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